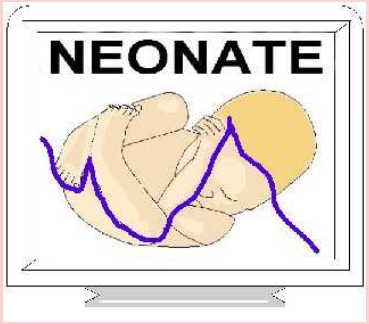
Medical Decision Making and Computer Support in Intensive Care



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British Association for the Advancement of Science. Leicester 12-09-02

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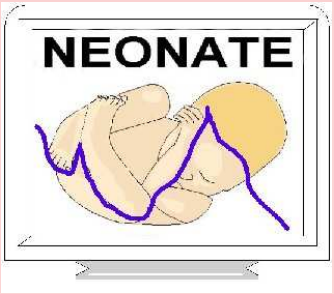

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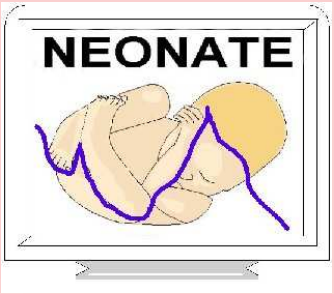

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People at the Centre of Computers and Information Technology

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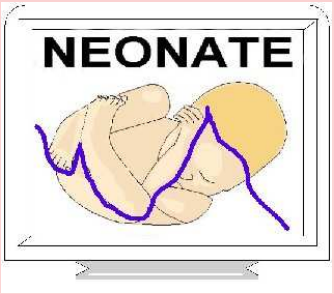
BACKGROUND



- Large volumes of data available to the medical and nursing staff in the Intensive Care Unit (ICU)
- Computerised aids in medicine for:
  - Data collection, Monitoring and Decision Support
  - Data as coherent information within a single display rather than across multiple monitor-specific displays


SLE2000

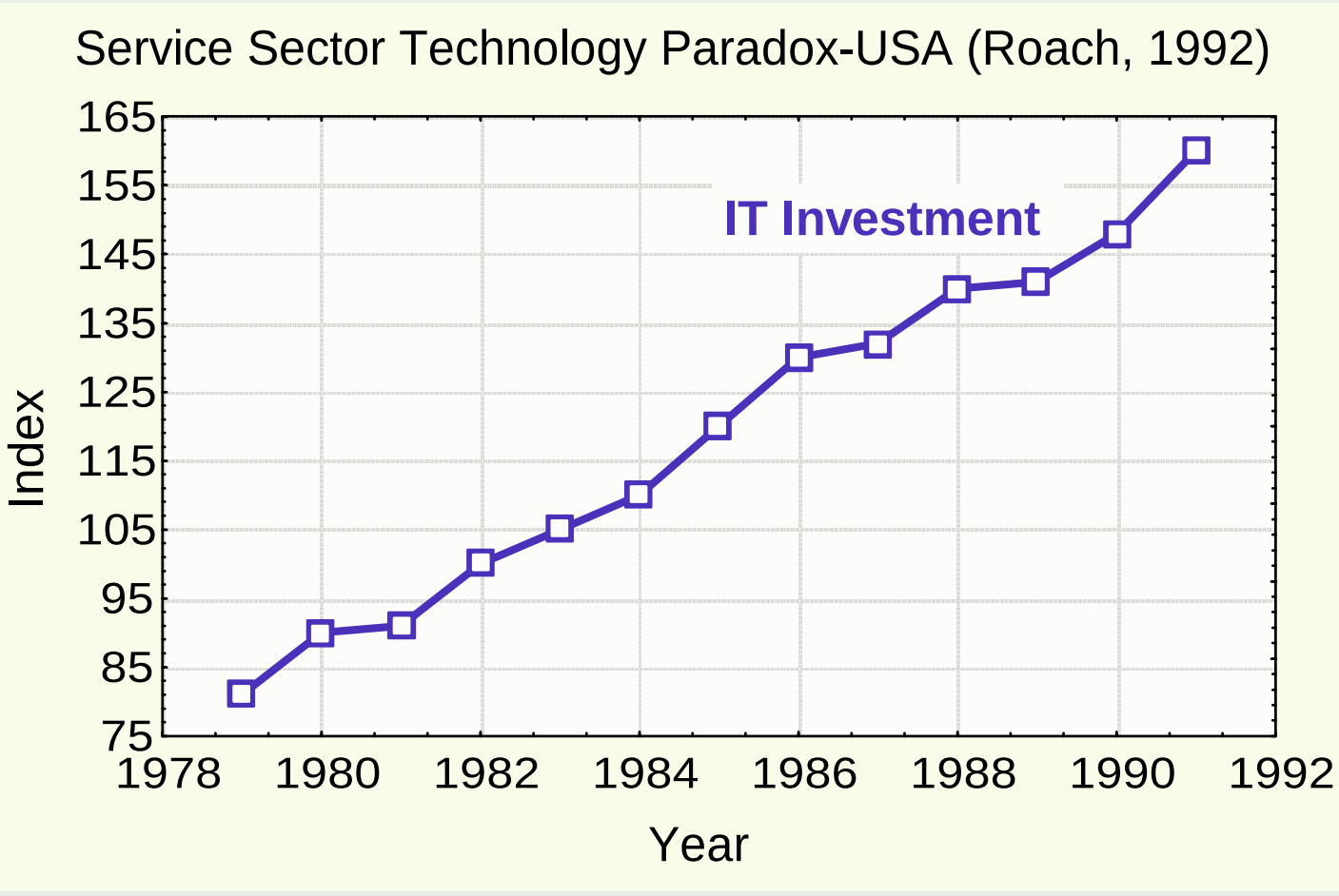
CAVEAT

- Existing systems **not** widely accepted or used by clinical staff
- Introduction of computer aids does **not** lead automatically to improvements in work efficiency or clinical outcome

Why?

The Public Impact

- **NHS ‘wasting millions on failed computer projects’**


Service Sector Technology Paradox-USA (Roach, 1992)
IT Investment
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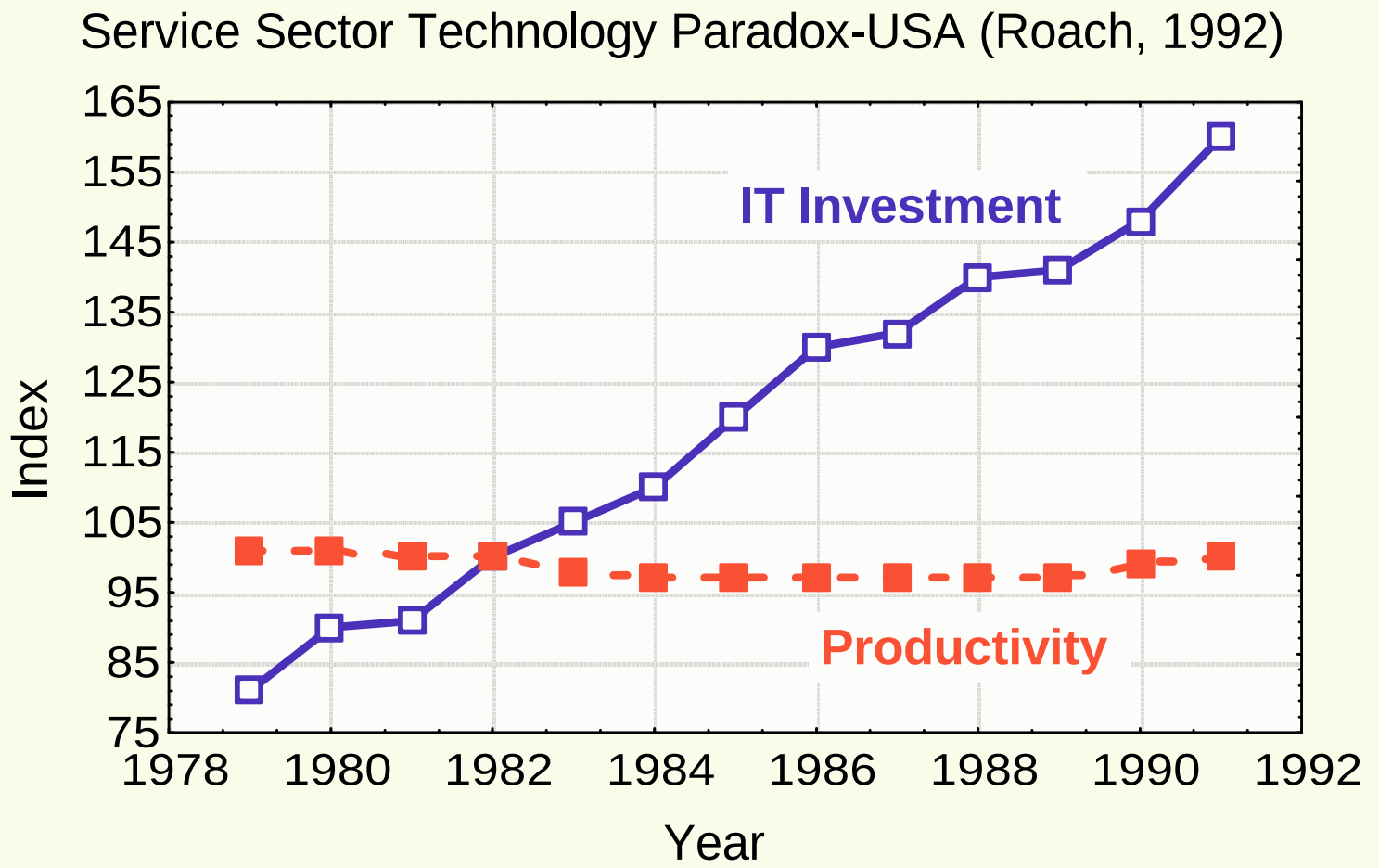
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Year
IT Investment
Productivity

Possible accounts for the paradox

- Need for regular upgrades to hardware and software
- Need to employ computer support staff and maintenance contracts
- More facilities offered/purchased than are required
- Staff spend time exploring facilities/upgrades
- Senior staff undertake work previously carried out by secretaries - e.g. fonts and layout
- Staff function effectively without the IT facilities

CANDIDATE ACCOUNTS in the Intensive Care Unit

- Computerised monitoring systems developed in consultation with senior physicians/medical IT enthusiasts who are probably the least frequent visitors to the bed/cot side
- Lack of understanding of **cognition** (the ‘mind’) of physicians and nurses at different levels of seniority
- Lack of understanding of **which** information is used and **how it is used** by different types of staff
- Lack of understanding of **working practices** of physicians and nurses at different levels of seniority

Approaches in NEONATE

- Psychological Science
  - Structured Interviews
  - On Ward Observations
  - Off Ward Simulations
  - Identify Biases
  - Identify Information sources
  - Identify organisation of knowledge
- Involve all staff grades

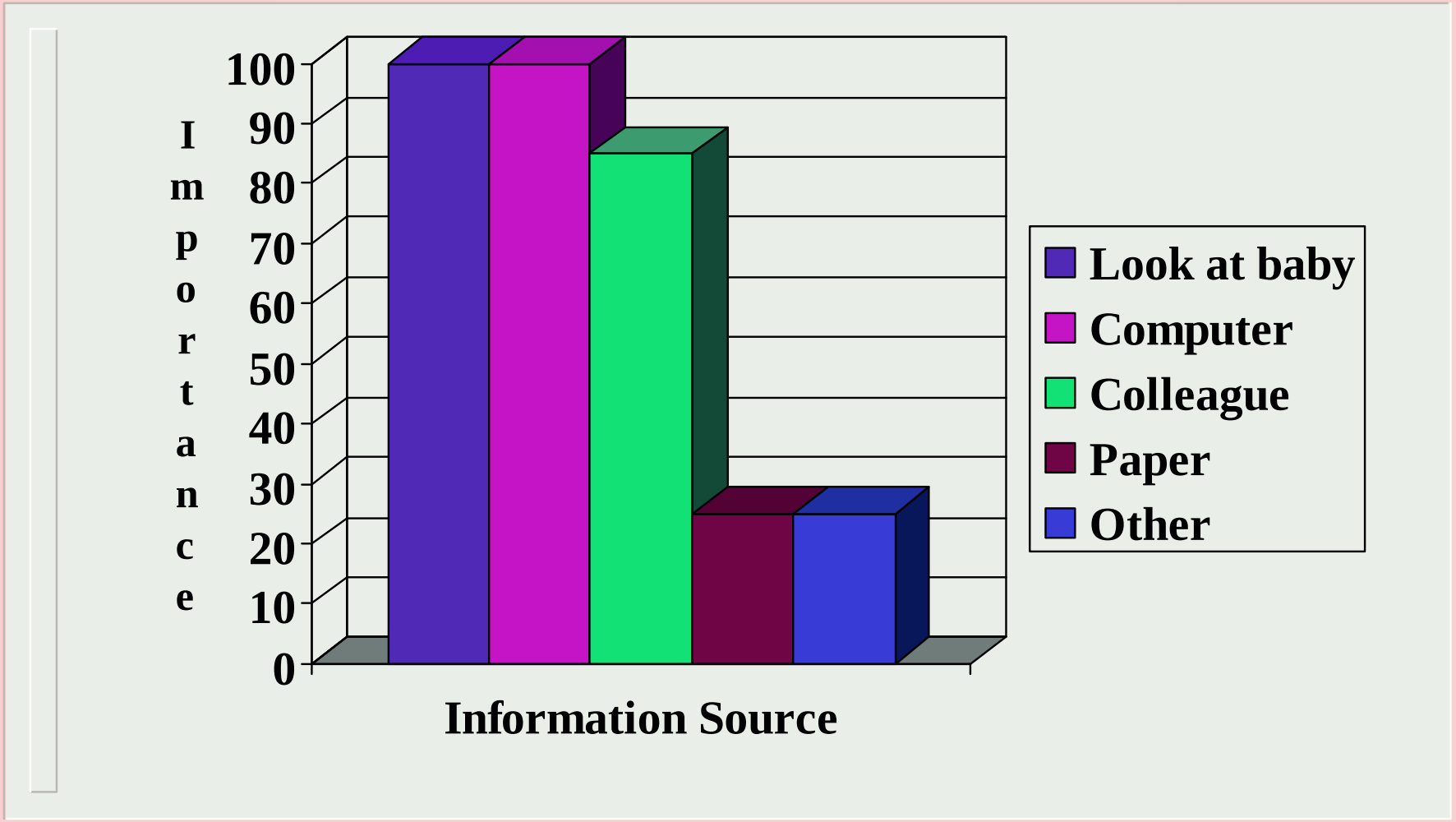
- Computer Science
  - Trend detection
  - Work bench for annotation on screen
  - Increase parameters recorded
  - Develop interface
  - Add interpreted and relevant information

INTERVIEWS with Senior Physicians

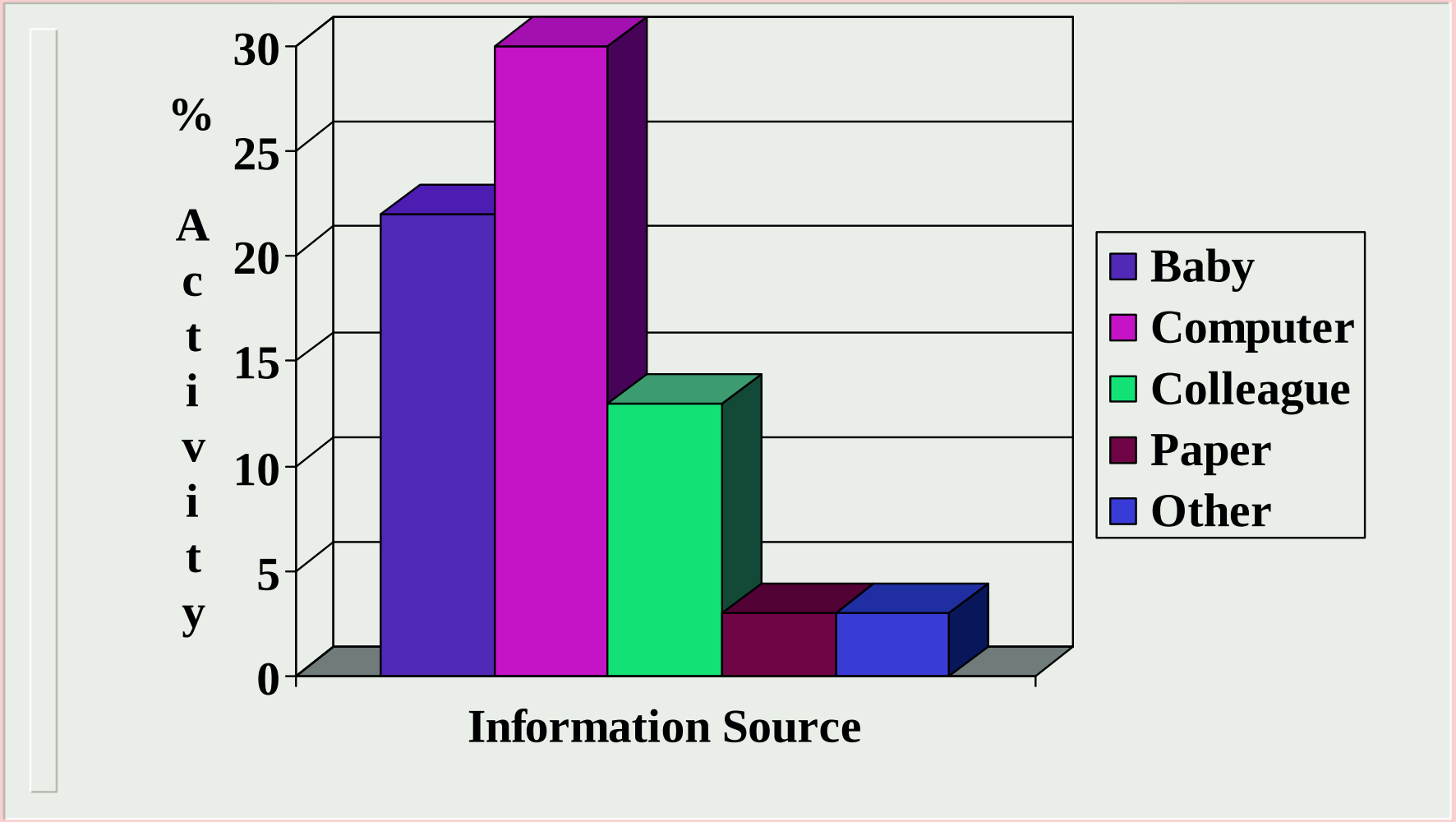
- least frequent visitor to cotside
- most familiar with the computer system, and report frequent use
- report ability to recognise artifacts (e.g probe change)

Reported sources of information regarding patient:

Senior Consultant - Interviews



Senior Consultant - Observed on Ward

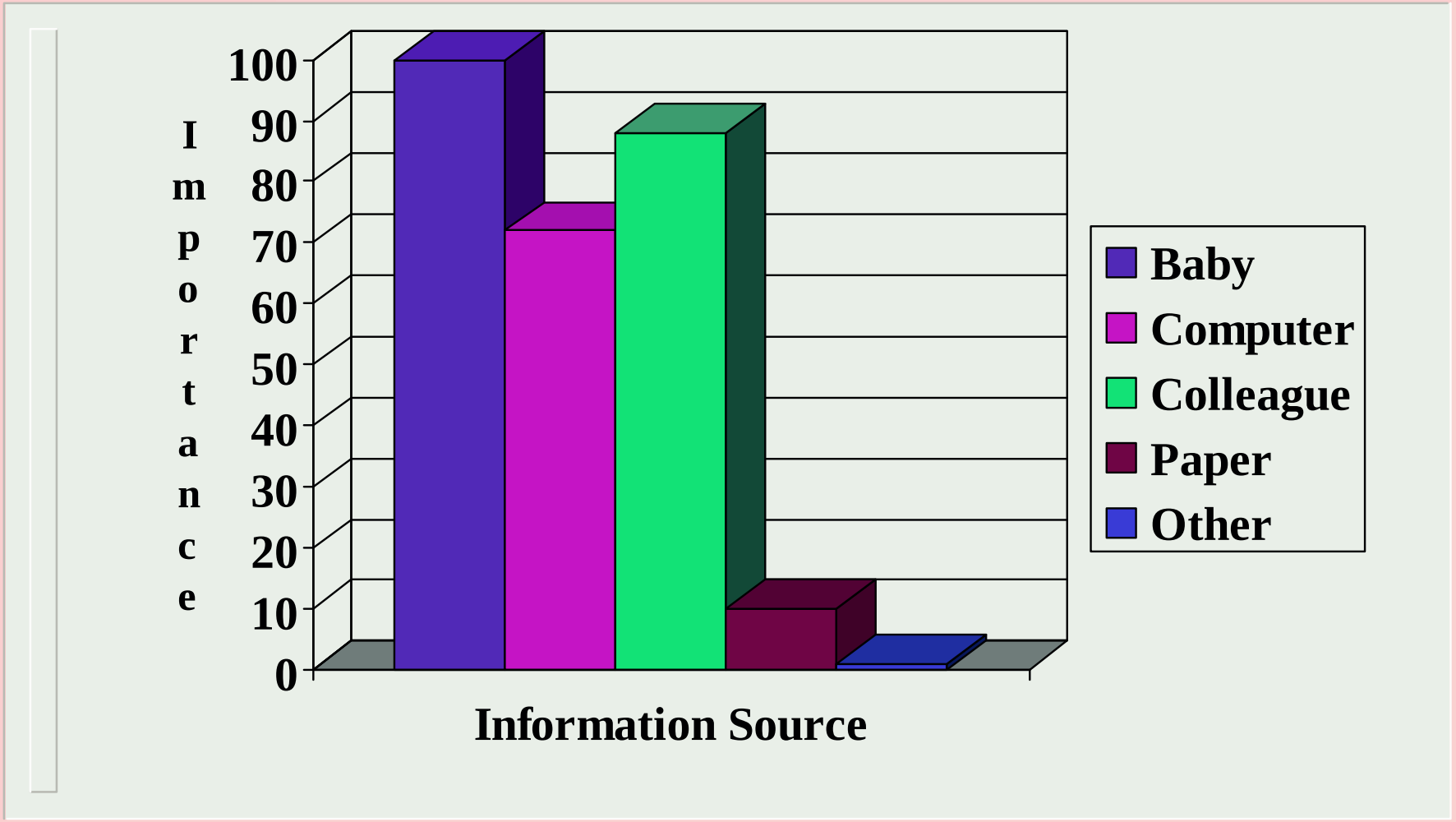


INTERVIEWS with Junior Physicians

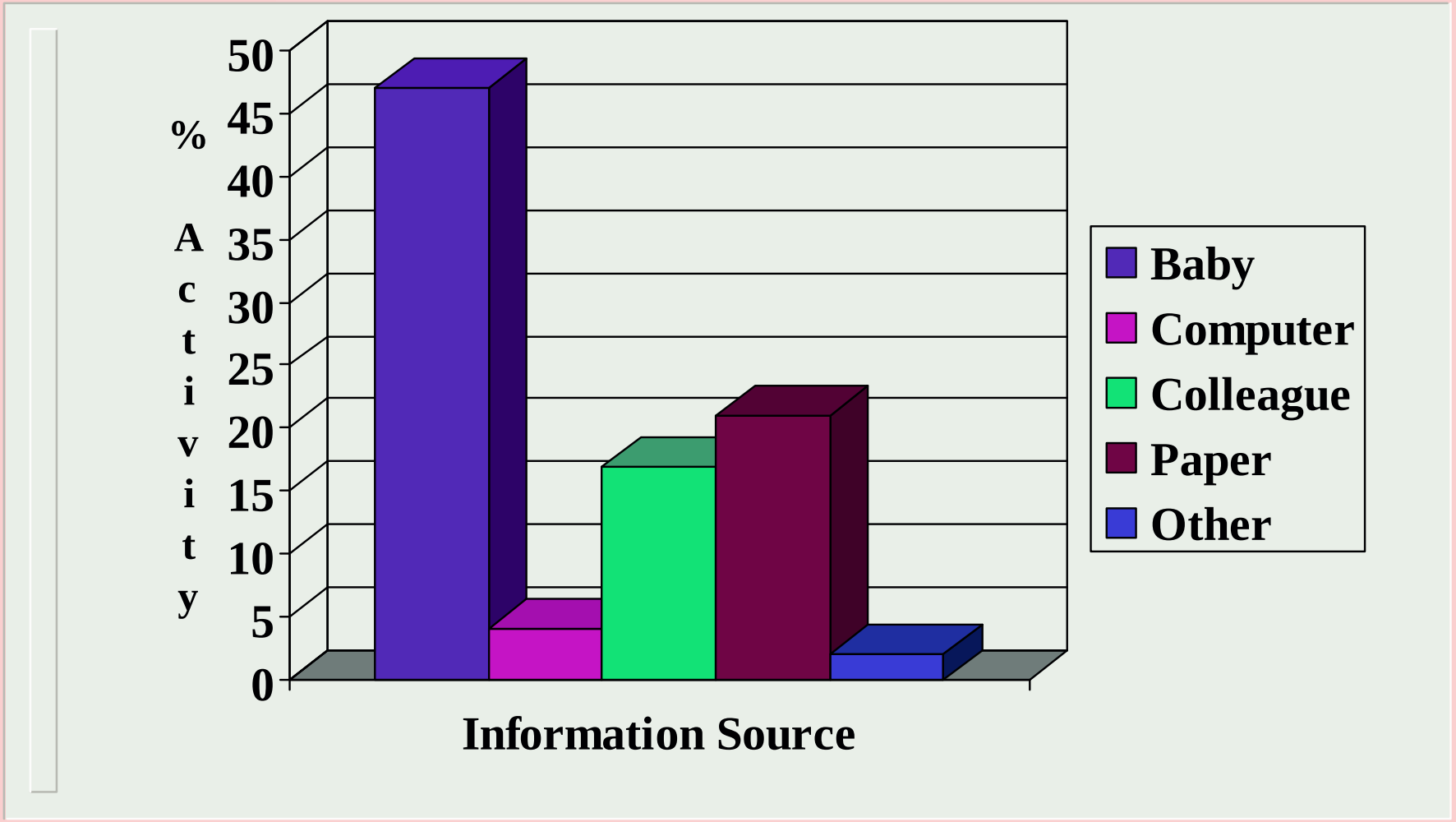
- regular visitor to cotside
- the **least familiar with** the computer system, but report frequent use
- most computer literate
- report difficulties with recognising **artifacts**
- concerned about **lack of training** with system

- Reported sources of information regarding patient are:

Junior Physicians - Interviews



Junior Physicians - Observed on Ward

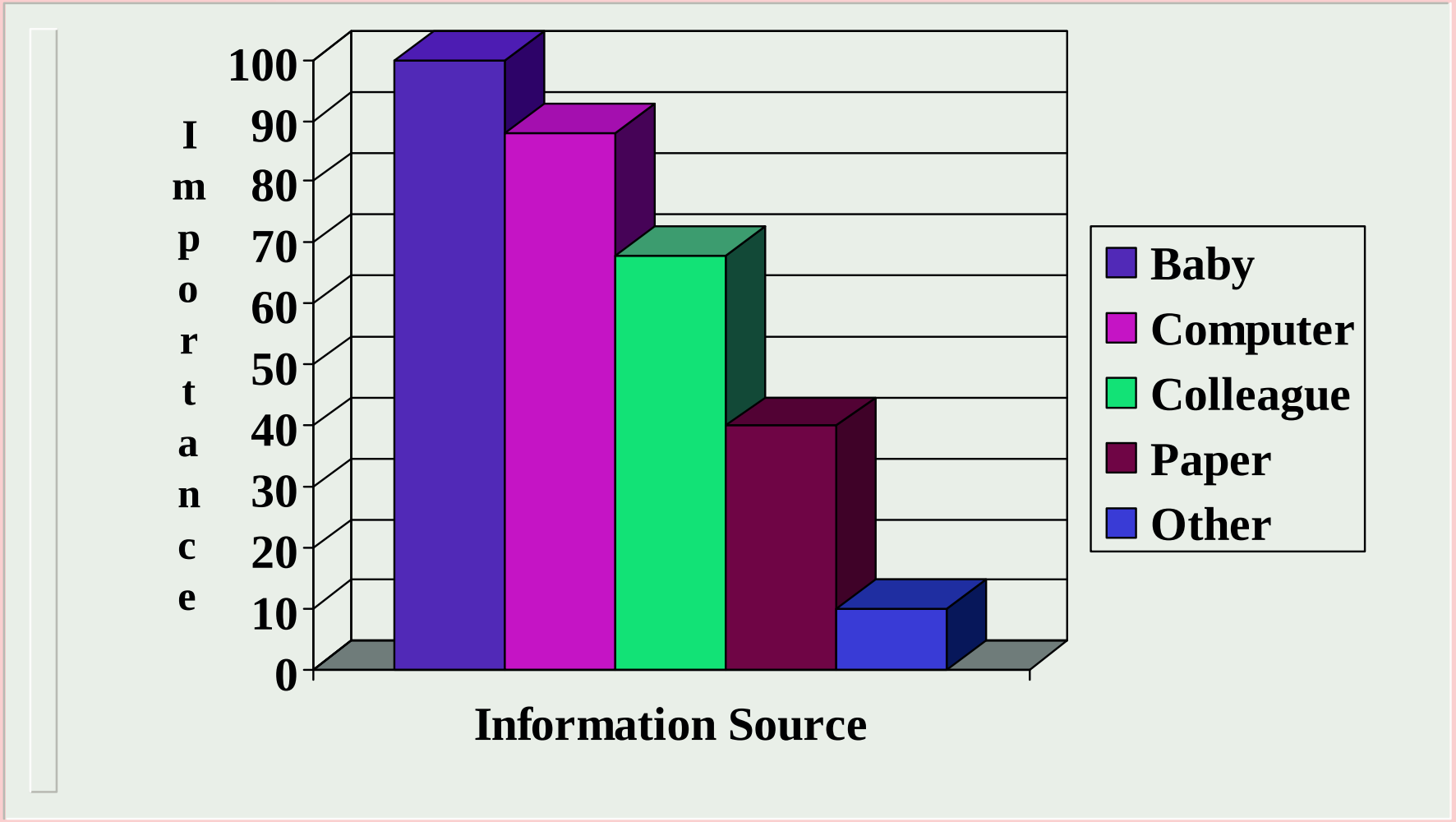


Interviews with Nurses

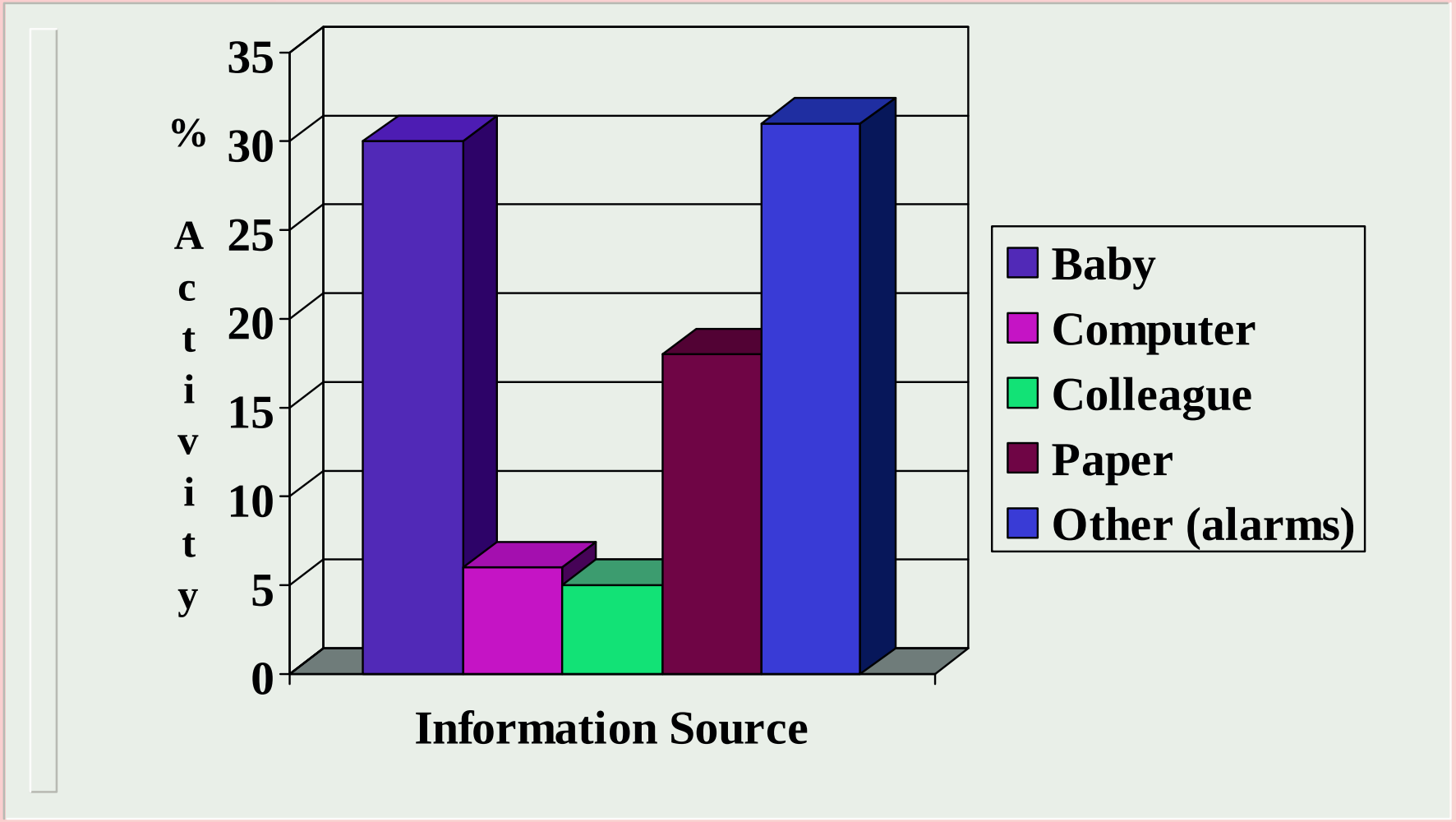
- most frequent visitors to cot-side
- report use of computer but unfamiliar with most of its facilities
- generate artifacts (e.g. probe change), so detection from computer not needed
- View the computer system as primarily a tool for use by senior physicians

- Reported sources of information regarding patient are:

Nurses - Interviews



Nurses - Observed on Ward



OFF-WARD SIMULATIONS

- Participants: Senior & Junior Physicians, Senior Nurses
- 14 traces: recorded from previous real babies (anonymised)
- Each trace: shown in 6 minute segments and then as a complete 2 hour block
- Participants:
  - asked to think-aloud as they interpreted the data
  - were allowed to request extra information

SAMPLE DATA TRACE

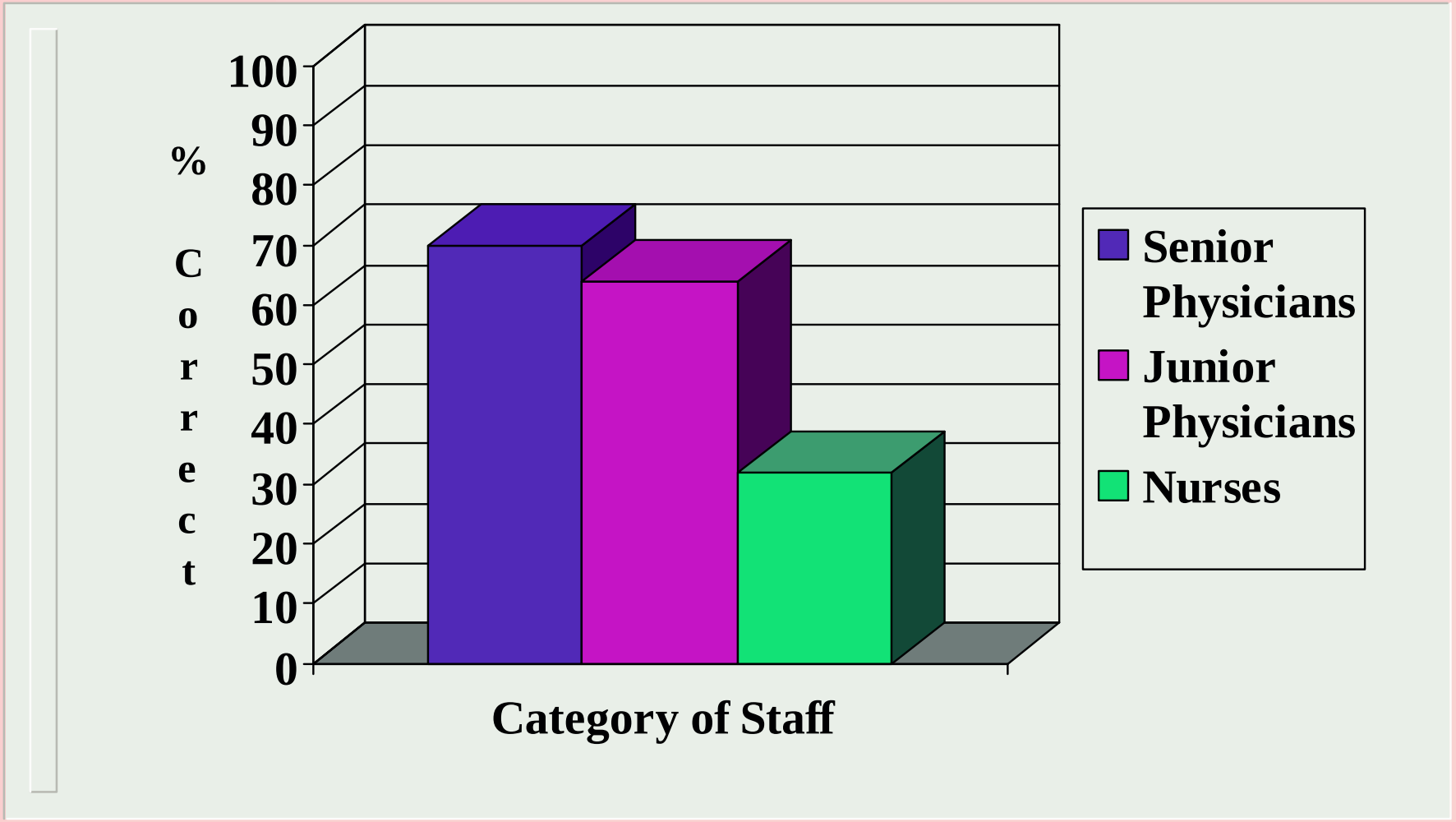
OFF-WARD SIMULATIONS

- Each trace was characterised by a “key event”:
  - Baby’s reactions to drug administration (4)
  - Spontaneously occurring events (4)
  - Baby’s reaction to regular procedures (4)
  - Control traces (2)
- Additionally, a clinical expert recorded for each trace a number of other important events & artefacts
- Each session was video-recorded, transcribed and subjected to protocol analysis
- Resulted in 27,000 statements

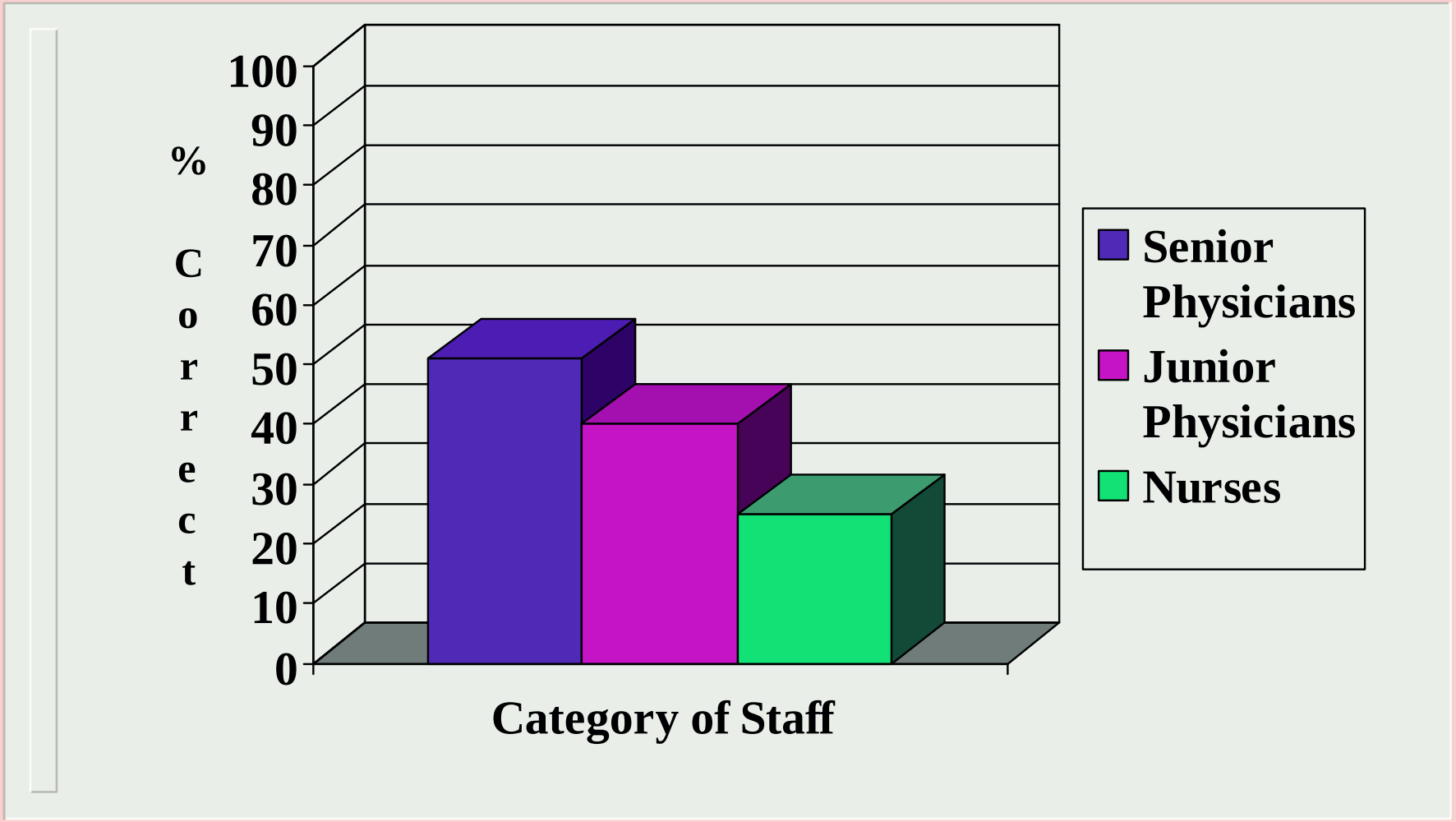
Questions from simulations

- Can staff detect a key event from the computer trace?
  - In retrospect (looking back over the data)
  - As it develops on the computer display
- Do staff correctly interpret patient state from the computer trace?
- Do experts agree on what are important events and what are artifacts (e.g probe change?)

Identify key events in retrospect



Detection of key events as they commence



OFF-WARD SIMULATION RESULTS-ctd.

Senior Physicians

- Correct interpretation of events against expert judgement: Senior=56% Junior=31%)
- 68% agreement among experts as to what are important events and artefacts in trace

Conclusions

- Results from senior physicians offer performance baselines for computerised monitoring and trend detection
- Crucial information can only ever be obtained directly from observing and examining the patient or from discussions with colleagues
- Computer systems cannot replace staff, for both practical and medico-legal reasons. They will only aid staff if they offer something that staff **at particular grades** find useful

On going research

- Identify the terms that different grades of staff use to describe the patient
- Identify the range of actions that different grades of staff perform
- Identify how each grade of staff organises their knowledge of terms and actions in their daily tasks (Card sorts)
- Develop computational algorithms for recording and display that will offer genuine help to the staff most often at the cotside

Conclusions

- Better computer monitoring systems might reduce non-optimal decisions and assist interpretation of patient state.
- NB - Errors may be detected and corrected before implementation.
- Computer support might ease the job of the professional carer and facilitate medical audit, but might continue to have only a small effect on clinical outcome.
- Likely to lead to increased rather than reduced costs of care.

We must never lose sight of ...

… our most important customer